

IN THE CLAIMS:

Please amend Claims 13-17, 20, 23-25, 38-42, 48-50, 63-67, 73, 75 and 83 as follows. A marked-up copy of the amended claims showing the changes made thereto, is attached. Note that all the claims currently pending in this application, including those not presently being amended, have been reproduced below for the Examiner's convenience.

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13. (Amended) An exposure apparatus, comprising:

first exposure means for illuminating a predetermined mask pattern with light of a predetermined wavelength under a first illumination condition, to print the same on a predetermined exposure region; and

second exposure means for illuminating the predetermined mask pattern with light of the predetermined wavelength under a second illumination condition, different from the first illumination condition, to print the same on the predetermined exposure region,

wherein exposures by said first and second exposure means are carried out prior to a development process.

14. (Amended) An exposure apparatus, comprising:

first exposure means for illuminating a predetermined mask pattern with a first sigma to print the same on a predetermined exposure region; and

second exposure means for illuminating the predetermined mask pattern with a second sigma, different from the first sigma, to print the same on the predetermined exposure region;

wherein exposures by said first and second exposure means are carried out prior to a development process.

15. (Amended) An exposure apparatus, comprising:

first exposure means for illumination a predetermined mask pattern with light of a first NA to print the same on a predetermined exposure region; and

second exposure means for illuminating the predetermined mask pattern with light of a second NA, different from the first NA, to print the same on the predetermined exposure region;

wherein exposures by said first and second exposure means are carried out prior to a development process.

16. (Amended) An exposure apparatus, comprising:

first exposure means for obliquely illuminating a predetermined mask pattern to print the same on a predetermined exposure region; and

second exposure means for perpendicularly illuminating the predetermined mask pattern to print the same on the predetermined exposure region,

~~wherein exposures by said first and second exposure means are carried out prior to a development process.~~

17. (Amended) An apparatus according to any one of Claims 13 - 16 wherein the mask pattern includes an opening pattern with a linewidth not greater than a resolution limit of an exposure apparatus to be used.

18. (Unamended) An apparatus according to Claim 17, wherein there are plural opening patterns juxtaposed with each other.

19. (Unamended) An apparatus according to Claim 17, wherein the mask pattern includes a phase shift pattern.

20. (Amended) An apparatus according to Claim 17, wherein there is a desired pattern and an auxiliary pattern having a shape different from that of a repetition of the desired pattern, disposed adjacent to the mask pattern.

21. (Unamended) An apparatus according to any one of Claims 13 - 16, wherein the mask pattern is illuminated light from one of KrF excimer laser, ArF excimer laser and F₂ excimer laser.

22. (Unamended) An apparatus according to any one of Claims 13 - 16,
wherein the mask pattern is projected by use of a projection optical system comprising one
of a dioptric system, a catadioptric system and a catoptric system.

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23. (Amended) An apparatus according to any one of Claims 13 - 16,
wherein the exposure wavelength of said first exposure means and the exposure
wavelength of said second exposure means are substantially the same.

24. (Amended) An apparatus according to any one of Claims 13 - 16,
wherein exposures of the exposure region under different illumination conditions are
performed simultaneously without interference of lights in the different illumination
conditions.

25. (Amended) A device manufacturing method, comprising the steps of:
exposing a wafer with a mask pattern by use of an exposure apparatus as
recited in any one of Claims 13- 16; and
developing the exposed wafer.

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38. (Amended) An exposure apparatus for illuminating a predetermined
mask pattern with an illumination system and for projecting light from the mask pattern

onto a predetermined exposure region through a projection system to print the mask pattern on the exposure region, said apparatus comprising:

first exposure means for illuminating the mask pattern under a first illumination condition and for projecting light from the mask pattern to the exposure region at a first spatial frequency passage spectrum of the projection system, so that the exposure region is exposed with the same; and

second exposure means for illuminating the mask pattern under a second illumination condition, different from the first illumination condition, and for projecting light from the mask pattern to the exposure region at a second spatial frequency passage spectrum of the projection system, different from the first spatial frequency passage spectrum, so that the exposure region is exposed with the same;

wherein exposures by said first and second exposure means are carried out prior to a development process.

39. (Amended) An exposure apparatus for illuminating a predetermined mask pattern with an illumination system and for projecting light from the mask pattern onto a predetermined exposure region through a projection system to print the mask pattern on the exposure region, said apparatus comprising:

first exposure means for illuminating the mask pattern with a first sigma and for projecting light from the mask pattern to the exposure region at a first

spatial frequency passage spectrum of the projection system, so that the exposure region is exposed with the same; and

second exposure means for illuminating the mask pattern with a second sigma, different from the first sigma, and for projecting light from the mask pattern to the exposure region at a second spatial frequency passage spectrum of the projection system, different from the first spatial frequency passage spectrum, so that the exposure region is exposed with the same;

wherein exposures by said first and second exposure means are carried out prior to a development process.

40. (Amended) An exposure apparatus for illuminating a predetermined mask pattern with an illumination system and for projecting light from the mask pattern onto a predetermined exposure region through a projection system to print the mask pattern on the exposure region, said apparatus comprising:

first exposure means for illuminating the mask pattern with a first NA and for projecting light from the mask pattern to the exposure region at a first spatial frequency passage spectrum of the projection system, so that the exposure region is exposed with the same; and

second exposure means for illuminating the mask pattern with a second NA, different from the first NA, and for projecting light from the mask pattern to the exposure region at a second spatial frequency passage spectrum of the projection

system, different from the first spatial frequency passage spectrum, so that the exposure region is exposed with the same;

wherein exposures by said first and second exposure means are carried out prior to a development process.

41. (Amended) An exposure apparatus for illuminating a predetermined mask pattern with an illumination system and for projecting light from the mask pattern onto a predetermined exposure region through a projection system to print the mask pattern on the exposure region, said apparatus comprising:

first exposure means for obliquely illuminating the mask pattern and for projecting light from the mask pattern to the exposure region at a first spatial frequency passage spectrum of the projection system, so that the exposure region is exposed with the same; and

second exposure means for perpendicularly illuminating the mask pattern and for projecting light from the mask pattern to the exposure region at a second spatial frequency passage spectrum of the projection system, different from the first spatial frequency passage spectrum, so that the exposure region is exposed with the same;

wherein exposures by said first and second exposure means are carried out prior to a development process.

42. (Amended) An apparatus according to any one of Claims 38 - 41,
wherein the mask pattern includes an opening pattern with a linewidth not greater than a
resolution limit of an exposure apparatus to be used.

43. (Unamended) An apparatus according to Claim 42, wherein there are
plural opening patterns juxtaposed with each other.

44. (Unamended) An apparatus according to Claim 42, wherein the mask
pattern includes a phase shift pattern.

45. (Unamended) An apparatus according to any one of Claims 38 - 41
wherein one of a shape of an aperture opening of the projection optical system and a
transmission factor distribution is changed to change the spatial frequency passage
spectrum of the projection optical system.

46. (Unamended) An apparatus according to any one of Claims 38 - 41,
wherein the mask pattern is illuminated light from one of KrF excimer laser, ArF excimer
laser and F₂ excimer laser.

47. (Unamended) An apparatus according to any one of Claims 38 - 41,
wherein the mask pattern is projected by use of a projection optical system comprising one
of a dioptric system, a catadioptric system and a catoptric system.

48. (Amended) An apparatus according to any one of Claims 38 - 41,
wherein the exposure wavelength of said first exposure means and the exposure
wavelength of said second exposure means are substantially the same.

49. (Amended) An apparatus according to any one of Claims 38 - 41,
wherein exposures of the exposure region under different illumination conditions are
performed simultaneously without interference of lights different in the different
illumination conditions.

50. (Amended) A device manufacturing method, comprising the steps of:
exposing a wafer with a mask pattern by use of an exposure apparatus as
recited in any one of Claims 38 - 41; and
developing the exposed wafer.

63. (Amended) An exposure apparatus, comprising:

first exposure means for illuminating a predetermined mask pattern with light of a predetermined wavelength under a first illumination condition, to print the same on a predetermined exposure region; and

second exposure means for illuminating the mask pattern with light of the predetermined wavelength under a second illumination condition, different from the first illumination condition, to print the same on the predetermined exposure region;

wherein the mask pattern has a desired pattern and an auxiliary pattern having a shape different from that of a repetition of the desired pattern; and

wherein exposures by said first and second exposure means are carried out prior to a development process.

64. (Amended) An exposure apparatus, comprising:

first exposure means for illuminating a predetermined mask pattern with light of a first sigma, to print the same on a predetermined exposure region; and

second exposure means for illuminating the mask pattern with light of a second sigma, different from the first sigma, to print the same on the predetermined exposure region;

wherein the mask pattern has a desired pattern and an auxiliary pattern having a shape different from that of a repetition of the desired pattern; and

wherein exposures by said first and second exposure means are carried out prior to a development process.

65. (Amended) An exposure apparatus, comprising:

first exposure means for illuminating a predetermined mask pattern with light of a first NA, to print the same on a predetermined exposure region; and

second exposure means for illuminating the mask pattern with light of a second NA, different from the first NA, to print the same on the predetermined exposure region;

wherein the mask pattern has a desired pattern and an auxiliary pattern having a shape different from that of a repetition of the desired pattern; and

wherein exposures by said first and second exposure means are carried out prior to a development process.

66. (Amended) An exposure apparatus, comprising:

first exposure means for obliquely illuminating a predetermined mask pattern, to print the same on a predetermined exposure region; and

second exposure means for perpendicularly illuminating the mask pattern to print the same on the predetermined exposure region;

wherein the mask pattern has a desired pattern and an auxiliary pattern having a shape different from that of a repetition of the desired pattern; and

wherein exposures by said first and second exposure means are carried out prior to a development process.

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67. (Amended) An apparatus according to any one of Claims 63 - 66, wherein the mask pattern includes an opening pattern with a linewidth not greater than a resolution limit of an exposure apparatus to be used.

68. (Unamended) An apparatus according to Claim 67, wherein there are plural opening patterns juxtaposed with each other.

69. (Unamended) An apparatus according to Claim 67, wherein the mask pattern includes a phase shift pattern.

70. (Unamended) An apparatus according to Claim 67, wherein there is an auxiliary pattern disposed adjacent to the opening pattern.

71. (Unamended) An apparatus according to any one of Claims 63 - 66, wherein the mask pattern is illuminated light from one of KrF excimer laser, ArF excimer laser and F₂ excimer laser.

72. (Unamended) An apparatus according to any one of Claims 63 - 66, wherein the mask pattern is projected by use of a projection optical system comprising one of a dioptric system, a catadioptric system and a catoptric system.

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73. (Amended) An apparatus according to any one of Claims 63 - 66,
wherein the exposure wavelength of said first exposure means and the exposure wavelength
of said second exposure means are substantially the same.

74. (Unamended) An apparatus according to any one of Claims 63 - 66,
wherein exposures of the exposure region under different illumination conditions are
performed simultaneously without mutual interference of lights in the different illumination
conditions.

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75. (Amended) A device manufacturing method, comprising the steps of:
exposing a wafer with a mask pattern by use of an exposure
apparatus as recited in any one of
Claims 63 - 66; and
developing the exposed wafer.

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83. (Amended) An exposure apparatus for illuminating a predetermined
mask pattern with an illumination system and for projecting light from the mask pattern
onto a predetermined exposure region through a projection system to print the mask pattern
on the exposure region, said apparatus comprising:
first exposure means for illuminating the mask pattern under a first
illumination condition and for projecting light from the mask pattern to the exposure region

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at a first spatial frequency passage spectrum of the projection system, so that the exposure region is exposed with the same; and

second exposure means for illuminating the mask pattern under a second illumination condition, different from the first illumination condition, and for projecting light from the mask pattern to the exposure region at a second spatial frequency passage spectrum of the projection system, different from the first spatial frequency passage spectrum, so that the exposure region is exposed with the same,

wherein the mask pattern has a repetition pattern comprising repeatedly disposed basic patterns, being defined by light transmissive portions,

wherein light passed through adjacent basic patterns of the repetition pattern have a mutual optical phase difference of about 180 deg., and

wherein exposures by said first and second exposure means are carried out prior to a development process.

Please add Claims 85-125 as follows:

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--85. (New) An exposure apparatus according to Claim 83, wherein the basic pattern comprises a pair of transmissive patterns, wherein corresponding light transmissive portions of the pair of transmissive patterns have a mutual optical phase difference of about 180 deg.

86. (New) An exposure apparatus according to Claim 83, wherein, as one illumination condition, approximately coherent illumination with a small effective light source is used.

87. (New) An exposure apparatus according to Claim 83, wherein one light passage condition of the pupil plane of the projection optical system is limiting a passage region by use of an aperture stop having an elongated opening, extending in a direction in which pattern resolution is high.

88. (New) An exposure apparatus according to Claim 83, wherein the illumination condition is changed upon switching of multiple exposures by use of illumination stop holding means having plural illumination stops one of which can be detachably inserted into a light path of the illumination optical system.

89. (New) An exposure apparatus according to Claim 83, wherein there are a light blocking plate having at least one opening and holding means for the light blocking plate, and wherein the illumination condition is changed by use of light blocking plate rotating means for rotationally moving the light blocking plate within the illumination optical system, upon switching of the multiple exposures.

90. (New) An apparatus according to Claim 83, wherein said first exposure means illuminates the mask pattern with a first sigma, and wherein said second exposure means illuminates the mask pattern with a second sigma, different from the first sigma.

91. (New) An apparatus according to Claim 83, wherein said first exposure means illuminates the mask pattern with a first NA, and wherein said second exposure means illuminates the mask pattern with a second NA, different from the first NA.

92. (New) An apparatus according to Claim 83, wherein said first exposure means illuminates the mask pattern obliquely, and wherein said second exposure means illuminates the mask pattern perpendicularly.

93. An apparatus according to Claim 83 wherein the mask pattern includes an opening pattern with a linewidth not greater than a resolution limit of an exposure apparatus to be used.

94. (New) An apparatus according to Claim 83, wherein there is a desired pattern and an auxiliary pattern having a shape different from that of a repetition of the desired pattern, disposed adjacent to the mask pattern.

95. (New) An apparatus according to Claim 83, wherein the mask pattern is illuminated light from one of KrF excimer laser, ArF excimer laser and F₂ excimer laser.

96. (New) An apparatus according to Claim 83, wherein the mask pattern is projected by use of a projection optical system comprising one of a dioptric system, a catadioptric system and a catoptric system.

97. (New) An apparatus according to Claim 83, wherein the exposure wavelength of said first exposure means and the exposure wavelength of said second exposure means are substantially the same.

98. (New) An apparatus according to Claim 83, wherein exposures of the exposure region under different illumination conditions are performed simultaneously without interference of lights in the different illumination conditions.

99. (New) A device manufacturing method, comprising the steps of:
exposing a wafer with a mask pattern by use of an exposure apparatus as recited in Claim 83; and
developing the exposed wafer.

100. (New) An apparatus according to Claim 13, wherein the illumination of the mask pattern is performed with bright field illumination.

101. (New) An apparatus according to Claim 14, wherein the illumination of the mask pattern is performed with bright field illumination.

102. (New) An apparatus according to Claim 15, wherein the illumination of the mask pattern is performed with bright field illumination.

103. An apparatus according to Claim 16, wherein the illumination of the mask pattern is performed with bright field illumination.

104. (New) An apparatus according to Claim 38, wherein the illumination of the mask pattern is performed with bright field illumination.

105. (New) An apparatus according to Claim 39, wherein the illumination of the mask pattern is performed with bright field illumination.

106. (New) An apparatus according to Claim 40, wherein the illumination of the mask pattern is performed with bright field illumination.

107. (New) An apparatus according to Claim 41, wherein the illumination of the mask pattern is performed with bright field illumination.

108. (New) An apparatus according to Claim 63, wherein the illumination of the mask pattern is performed with bright field illumination.

109. (New) An apparatus according to Claim 64, wherein the illumination of the mask pattern is performed with bright field illumination.

110. (New) An apparatus according to Claim 65, wherein the illumination of the mask pattern is performed with bright field illumination.

111. (New) An apparatus according to Claim 66, wherein the illumination of the mask pattern is performed with bright field illumination.

112. (New) An apparatus according to Claim 83, wherein the illumination of the mask pattern is performed with bright field illumination.

113. (New) An apparatus according to Claim 13, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means

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produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

114. (New) An apparatus according to Claim 14, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

115. (New) An apparatus according to Claim 15, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

116. (New) An apparatus according to Claim 16, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means

produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

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117. (New) An apparatus according to Claim 38, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

118. (New) An apparatus according to Claim 39, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

119. (New) An apparatus according to Claim 40, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means

produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

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120. (New) An apparatus according to Claim 41, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

121. (New) An apparatus according to Claim 63, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

122. (New) An apparatus according to Claim 64, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means

produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

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123. (New) An apparatus according to Claim 65, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

124. (New) An apparatus according to Claim 66, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means produces a second region in which an exposure amount does not reach the exposure threshold value, and wherein the exposure threshold value is reached in at least a portion of the first and second regions as superposed with each other.

125. (New) An apparatus according to Claim 83, wherein the exposure by said first exposure means produces a first region in which an exposure amount does not reach an exposure threshold value, while the exposure by said second exposure means